IDENTIFICATION OF THE SEX CHROMOSOMES OF THE RED-TAILED HAWK (*BUTEO JAMAICENSIS*) BY C- AND G-BANDING

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Abstract

We analyzed the mitotic chromosomes from a Red-tailed Hawk using G- and C-banding techniques. We found the Z chromosome to be the largest and the W chromosome to be the eighth largest. Other chromosomal characteristics and possible causes for incorrect sex chromosome identification in earlier reports are discussed.

Introduction

The difficulties encountered by aviculturists in accurately determining the sex of many captive birds has been one of the basic problems impeding efforts aimed at reproducing rare forms in captivity. Pape and Ogasawara (1978) indicate, in their study of the karyotype of the Red-tailed Hawk (*Buteo jamaicensis*), that captive birds of prey are not always easy to sex. They used feather pulp to obtain chromosome preparations and by analysis of such undifferentially stained preparations were able to sex their captive birds.

The technique of chromosome banding yields much more reliable data on sex chromosomes and chromosome homologies. Since the chromosomes they selected as representing the Z and W chromosomes (fourth largest chromosome pair) did not correspond to those published for raptors by Takagi and Sasaki (1974), Kaul and Ansari (1975), and Mengden and Stock (1976), we analyzed the C- and G-banded chromosomes of the Red-tailed Hawk to identify the actual sex chromosomes in that species.

Materials and Methods

Pinfeathers were removed from a recently road-killed Red-tailed Hawk. Preparation of chromosome spreads from the feather pulp tissue followed the squash technique of Mengden and Stock (1976). Some pulp tissue was cultured to obtain cell harvests high in mitotic index (Stock and Mengden 1975). Usable material was obtained by both direct squash and culture methods although the quality of banding was much better with material from cell culture. G-banding followed the procedures of Stock et al. (1974). C-banding was accomplished by the alkaline SSC method of Stefos and Arrighi (1971).

Results

Counts from 20 well-spread metaphase complements indicate a 2n of 68. Analysis of G-banded metaphase chromosomes (fig. 1) indicates the largest chromosome of the complement lacks a banding pattern homologue. The eighth largest chromosome in the

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complement also lacks a matching homologue. All other chromosome pairs can be matched. C-banded metaphase chromosomes (fig. 2) show the largest chromosome to be the Z and the eighth largest chromosome to be the W chromosome (which is almost entirely heterochromatic and is easily recognizable). Most autosomes possess some heterochromatin near the centromere although a few pairs, especially the larger ones, possess very little heterochromatin. The six smallest pairs of chromosomes are largely heterochromatic. Chromosome pair #4 in the G-banded karyotype possesses a large nonstaining region on the short arm near the centromere; and C-banding (fig. 2) reveals a large block of heterochromatin near the centromere. Much of the nonstaining region on chromosome #4, however, is distal to the heterochromatic region. This pair of chromosomes often shows an end-to-end association, hence the nonstaining region probably represents a nucleolar organizer region (NOR).

Discussion

The count of 34 pairs of chromosomes (2n = 68) reported by Pape and Ogasawara (1978) for the species is supported by this study. Almost all metaphase spreads counted possessed this number. Random loss of chromosomes during preparation accounted for the few lower counts obtained. Raptors usually possess fewer chromosomes than is the case in most other bird groups. Even with their reduced number of chromosomes, however, matching by centromeric index is difficult because of differential contraction of homologues. Selection of the wrong chromosomes as sex chromosomes is typical of errors that can result from the use of non-differentially stained chromosomes.

In cases where the W chromosome is large (many raptors), mistakes are frequent and may cause one to assume the wrong sex for the bird being studied. The feather-pulp method (Mengden and Stock 1976, Pape and Ogasawara 1978), combined with C-banding techniques, accurately determines a bird's sex. Such methodology can be employed with a minimum of expense and time and yields far more reliable information than do techniques such as laparotomy or analysis of fecal steroids (Risser 1977). The use of C-banding precludes the laborious task of obtaining centromeric index data and arranging the chromosomes into a karyotype as one can observe the W chromosome, if present, very readily in the spread of metaphase chromosomes. It may be possible to detect the W chromosome heterochromatin in interphase cells in species where the amount of autosomal heterochromatin does not interfere with clear visualization of the W-body (Stefos and Arrighi 1971).

The use of a mitotic arrester, such as colcemid, by direct injection into the bird, is not a good practice and may damage the bird by producing chromosomal abnormalities such as tetraploidy in cells blocked at metaphase. The resultant effects on breeding birds should be avoided. The practice is not necessary as the mitotic arrester can be successfully used in the hypotonic treatment (Mengden and Stock 1976) in the case of pinfeathers or prior to harvest in the case of cell culture.

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Ed. Note: Sample size is reportedly not a concern in studies of this type.

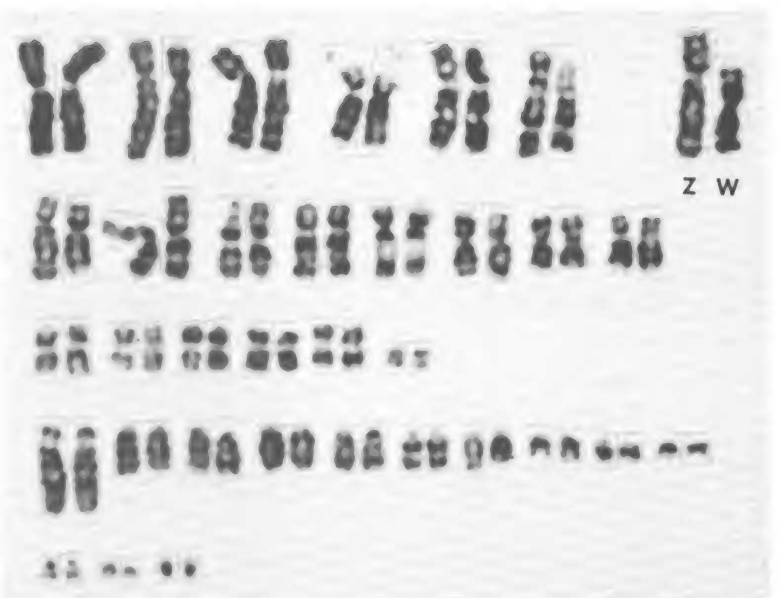

Figure 1. G-banded karyotype of the Red-tailed Hawk.

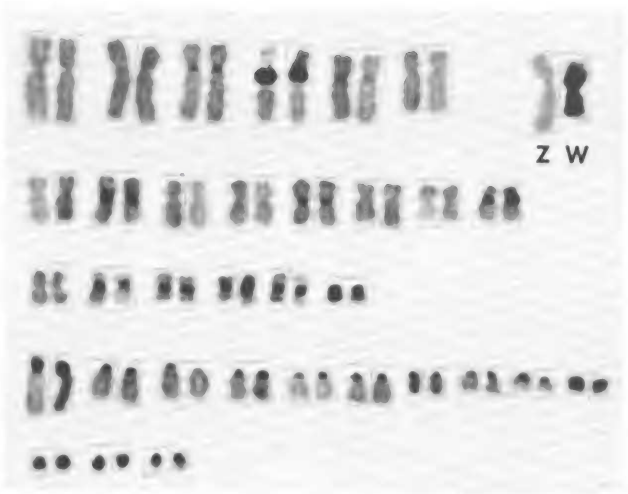

Figure 2. C-banded karyotype of the Red-tailed Hawk.

THE NESTING OF AN ALBINISTIC RED-TAILED HAWK (*BUTEO JAMAICENSIS*) IN OREGON

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Although albinism among Red-tailed Hawks (*Buteo jamaicensis*) has been reported (Emerson 1897, Ross 1963, Gross 1965, West 1971, Melquist and Shroeder 1974, Eckert 1974, Harris 1977, Follen 1979), there are few reports of the pairing and nesting of albinistic Red-tailed Hawks. Emerson (1897) stated that the albinistic bird he observed was paired, but he was unable to locate the nesting site. Recently Follen (1979) reported the pairing of an albinistic Redtail, but he gave no information whether nesting occurred.

Because of the lack of data regarding the nesting of albinistic Red-tailed Hawks, and also because of the supposed rarity of albino western Redtails (Austing 1964, Melquist and Shroeder 1974), we believe the following information to be noteworthy.